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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/890,860	10/16/2001	Keith Herbert Dodd	899-26	7954

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EXAMINER	
AUGHENBAUGH, WALTER	
ART UNIT	**PAPER NUMBER**
1772	

DATE MAILED: 12/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/890,860	DODD ET AL.	
	Examiner	Art Unit	
	Walter B. Aughenbaugh	1772	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 03 October 2005.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *53-61 and 64-67* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *53-61 and 64-67* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Acknowledgement of Applicant's Amendments

1. The amendments made in claims 53, 56 and 58 in the Amendment filed on October 3, 2005 (Amdt. F) have been received and considered by Examiner.

2. Claims 66 and 67 are incorrectly identified as "(new)" in Amdt. F. Claims 66 and 67 were presented in the Amendment filed on May 18, 2005, have not been amended in Amdt. F and should therefore be identified as "(Previously Presented)".

WITHDRAWN REJECTIONS

3. The 35 U.S.C. 112 rejection of claim 56 made of record in paragraph 8 of the previous Office Action mailed July 1, 2005 has been withdrawn due to Applicant's amendment in claim 56 in Amdt. F.

4. The 35 U.S.C. 103 rejection of claims 53-61 made of record in paragraph 9 of the previous Office Action mailed July 1, 2005 has been withdrawn due to Applicant's amendments in claims 53 and 58 in Amdt. F.

5. The 35 U.S.C. 103 rejection of claims 64-67 made of record in paragraph 10 of the previous Office Action mailed July 1, 2005 has been withdrawn due to Applicant's amendments in claims 53 and 58 in Amdt. F.

NEW REJECTIONS

Claim Rejections - 35 USC § 103

6. Claims 53-61 are rejected under 35 U.S.C. 103(a) as being unpatentable over Swozil et al. in view of Baurmeister.

In regard to claims 53, 54 and 58, Swozil et al. teach an elongate tubular heat transfer element (a tube for a shell and tube heat exchanger, col. 1, lines 37-39) comprising a wall (the fiber layer taught by Swozil et al. that comprises fibers coated with a fluorine-containing polymer, col. 1, lines 37-45 and 57-65 and col. 1, line 66-col. 2, line 15). The wall of Swozil et al. is of monolithic construction (since it is "cast as a single piece", see attached Merriam-Webster Online Dictionary definition 2a of "monolithic") and necessarily has an inner surface and an outer surface. Swozil et al. teach that glass fibers are a suitable corrosion resistant fiber and that corrosion resistant fibers are necessary (col. 3, lines 1-9). Swozil et al. teach polyvinylidene fluoride as a suitable fluorine containing polymer (col. 1, lines 6-21 and col. 3, lines 4-12). Swozil et al. therefore teach that the wall is formed from a composite material consisting essentially of a matrix of polyvinylidene fluoride having rovings of boron-free chemically resistant glass fibers embedded in the matrix (Swozil et al. does not require that the glass fibers comprise boron, and therefore, boron-free chemically resistant glass fibers fall within the scope of the glass fibers taught by Swozil et al.). Swozil et al. teach that the fibers are oriented cross-wise at an angle of approximately 60° on the tube body (col. 1, line 66-col. 2, line 4 and col. 4, lines 19-23 and 44-48). Swozil et al. teach that fiber strips may alternate with strips of an uncovered tube surface (col. 3, lines 43-47).

Swozil et al. fail to explicitly teach that the inner surface of the wall determines a boundary of a hollow interior which extends longitudinally of the axis of the tube, that the composite material is in contact with the hollow interior, that the rovings comprise from about 20% to about 60% by volume based upon the volume of the composite material and that the

rovings include rovings which extend longitudinally in a lengthwise direction parallel to the tube axis of the tubular heat transfer element and rovings which extend spirally around the tube axis.

Baurmeister, however, disclose a heat exchange tube (col. 9, lines 7-14, col. 14, lines 15-19, col. 3, lines 50-56, col. 4, lines 66-67, col. 5, lines 29-34 and 42-49, col. 8, lines 43-45 and Fig. 1 and 5) comprising fibers oriented in a direction parallel to the tube axis and fibers which extend spirally around the tube axis (Fig. 2). Baurmeister disclose that the arrangement of fibers taught by Baurmeister assures improved convective heat transport and increased heat transfer (col. 2, lines 38-45). Therefore, one of ordinary skill in the art would have recognized to have arranged the fiber strips of Swozil et al. in the pattern taught by Baurmeister since a web comprising fibers oriented in a direction parallel to the tube axis and fibers which extend spirally around the tube axis is well known to assure improved convective heat transport and increased heat transfer in heat exchange tubes as taught by Baurmeister. The structure that results from arrangement of the fiber strips of Swozil et al. in the pattern taught in Fig. 2 of Baurmeister necessarily results in spaces between the uncovered portions of the tube surface (taught by Swozil et al. at col. 3, lines 43-44) and the portions of the spirally oriented fiber strips that do not overlap with the longitudinally oriented strips: each of these spaces correspond to a hollow interior which extends longitudinally of the axis of the tube as claimed (each of the spaces extends longitudinally over a portion of the axis of the tube, therefore, each of these spaces extends longitudinally of the axis of the tube as claimed). The inner surface of the wall taught by Swozil et al. and Baurmeister therefore determines a boundary of each of the hollow interiors located between the wall taught by Swozil et al. and Baurmeister and the tube of Swozil et al. The composite material having the structure taught by Swozil et al. and Baurmeister is in contact

with each of the hollow interiors located between the wall taught by Swozil et al. and Baurmeister.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have arranged the fiber strips of Swozil et al. in the pattern taught by Baurmeister since a web comprising fibers oriented in a direction parallel to the tube axis and fibers which extend spirally around the tube axis is well known to assure improved convective heat transport and increased heat transfer in heat exchange tubes as taught by Baurmeister.

Furthermore, Swozil et al. teach that the fibers within the matrix reinforce the heat transfer element (col. 2, lines 12-18). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have determined the optimum volume of glass fiber in terms of percentage of the volume of the composite material to use in the heat exchange element taught by Swozil et al. and Baurmeister that would yield the desired degree of reinforcement of the element depending on the desired end user result, in the absence of unexpected results.

In regard to claims 55 and 59, Swozil et al. fail to explicitly teach that the tube further comprises a first layer adjacent the outer surface of the wall, a second layer surrounding the first layer and at least one other layer intermediate the first and second layers wherein the first, second and the at least one other intermediate layers each include rovings wherein the rovings of a particular layer all extend substantially in a common direction which is different from the common direction of any adjacent layer, wherein the common direction is in each case selected from a direction extending spirally around the tube axis and a direction extending longitudinally in a lengthwise direction parallel to the tube axis. Baurmeister, however, disclose that the tube

has three or more layers of fibers wherein the direction of the fibers in a particular layer alternates between a direction extending spirally around the tube axis (helically as taught by Baurmeister, see col. 4, lines 4-13) and a direction extending longitudinally in a lengthwise direction parallel to the tube axis (rectilinearly as taught by Baurmeister, see col. 4, line 56) (col. 4, lines 53-63). Therefore, one of ordinary skill in the art would have recognized to have added at least three additional layers of fibers to the tube taught by Swozil et al. and Baurmeister wherein the direction of the fibers in a particular layer alternates between a direction extending spirally around the tube axis and a direction extending longitudinally in a lengthwise direction parallel to the tube axis as taught by Baurmeister since a tube of at least four layers (the wall as claimed by Applicant and at least three additional layers, which is taught in the embodiment of Baurmeister at col. 4, lines 57-59 where there are four layers) where the orientation of the fibers of each layer alternates from layer to layer is a well known structure for heat exchange tubes as taught by Baurmeister.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have added at least three additional layers of fibers to the tube taught by Swozil et al. and Baurmeister wherein the direction of the fibers in a particular layer alternates between a direction extending spirally around the tube axis and a direction extending longitudinally in a lengthwise direction parallel to the tube axis as taught by Baurmeister since a tube of at least four layers (the wall as claimed by Applicant and at least three additional layers, which is taught in the embodiment of Baurmeister at col. 4, lines 57-59 where there are four layers) where the orientation of the fibers of each layer alternates from layer to layer is a well known structure for heat exchange tubes as taught by Baurmeister.

In regard to claims 56 and 60, Swozil et al. fail to explicitly teach that the wall comprises the three layers as claimed in claims 56 and 60. Baurmeister, however, disclose that the tube comprises three layers of fibers wherein the direction of the fibers in a particular layer alternates between a direction extending spirally around the tube axis (helically as taught by Baurmeister, see col. 4, lines 4-13) and a direction extending longitudinally in a lengthwise direction relative to the tube axis (rectilinearly as taught by Baurmeister, see col. 4, line 56) (col. 4, lines 53-63). Therefore, one of ordinary skill in the art would have recognized to have formed the wall of the tube of Swozil et al. such that it comprises three layers where the fibers of the intermediate layer extend longitudinally in a lengthwise direction relative to the tube axis and the fibers of the inner and outer layers extend spirally around the tube axis as taught by Baurmeister since a tube comprising three layers where the fibers of the intermediate layer extend longitudinally in a lengthwise direction relative to the tube axis and the fibers of the inner and outer layers extend spirally around the tube axis is a well known structure for heat exchange tubes as taught by Baurmeister.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have formed the wall of the tube of Swozil et al. such that it comprises three layers where the fibers of the intermediate layer extend longitudinally in a lengthwise direction relative to the tube axis and the fibers of the inner and outer layers extend spirally around the tube axis as taught by Baurmeister since a tube comprising three layers where the fibers of the intermediate layer extend longitudinally in a lengthwise direction relative to the tube axis and the fibers of the inner and outer layers extend spirally around the tube axis is a well known structure for heat exchange tubes as taught by Baurmeister.

In regard to claims 57 and 61, Swozil et al. fail to explicitly teach that the rovings in the intermediate layer comprise about 60% of the total rovings and that the rovings of the first and second layers together comprise about 40% of the total of all rovings in the heat transfer element. Baurmeister, however, disclose that the wall thicknesses of the various fibers (therefore, of the various layers) can be different from each other (col. 5, lines 26-28). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have varied the relative thicknesses of the different layers of the tube taught by Swozil et al. and Baurmeister in order to achieve the desired properties of the tube, such as flexibility in either of the transverse or longitudinal directions, depending on the desired end result, in the absence of unexpected results.

7. Claims 64-67 are rejected under 35 U.S.C. 103(a) as being unpatentable over Swozil et al. in view of Baurmeister and in further view of O'Connor.

Swozil et al. and Baurmeister teach the heat transfer element as discussed above. Swozil et al. and Baurmeister fail to teach that the composite material further comprises a particulate metal. O'Connor, however, discloses that suitable materials for the reinforcement of thermoplastic materials are glass fibers and metal fibers such as iron fibers or a mixture of glass fibers and metal fibers (col. 3, lines 25-31). In further regard to claims 66 and 67, metal is, by definition, thermally conductive. Therefore, one of ordinary skill in the art would have recognized to have used metal fibers such as iron fibers in combination with the glass fibers of Swozil et al. as a reinforcing agent, since it is well known to use a combination of glass and metal fibers as reinforcing agents of thermoplastic material as taught by O'Connor.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used metal fibers such as iron fibers in combination with the glass fibers of Swozil et al. as a reinforcing agent, since it is well known to use a combination of glass and metal fibers as reinforcing agents of thermoplastic material as taught by O'Connor.

Response to Arguments

8. Applicant's arguments regarding the applicability of Swozil et al. presented on pages 6 and 7 of Amdt. F have been fully considered but are not persuasive.

Applicant argues that the wall of Swozil et al. is not monolithic because "first of all the tube is produced and then the remaining components are added". Applicant fails to recognize here that the previous Office Action does not identify the tube of Swozil et al. as corresponding to the wall as claimed by Applicant. The fiber layer taught by Swozil et al. that comprises fibers coated with a fluorine-containing polymer (col. 1, lines 37-45 and 57-65 and col. 1, line 66-col. 2, line 15) is identified in the previous Office Action (and in this Office Action) as corresponding to the wall as claimed by Applicant. In the first full paragraph of page 7 of Amdt. F, Applicant argues that the fiber layer of Swozil et al. "cannot be regarded as 'cast as a single piece'", and notes that there is "formation of intimate bonds" between the fibers and the polymeric coating, but it is the fact that there is "formation of intimate bonds" between the fibers and the polymeric coating in the fiber layer that makes the fiber layer cast as a single piece.

9. Applicant's arguments regarding the applicability of Baurmeister presented on pages 7 and 8 of Amdt. F have been fully considered but are not persuasive.

Applicant argues that Baurmeister does not teach a heat exchange tube. As stated above, Baurmeister disclose a heat exchange tube (col. 9, lines 7-14, col. 14, lines 15-19, col. 3, lines

50-56, col. 4, lines 66-67, col. 5, lines 29-34 and 42-49, col. 8, lines 43-45 and Fig. 1 and 5). For example, a heat exchange tube is plainly taught in Fig. 5 and the accompanying description at col. 9, lines 5-14. Applicant included col. 5, lines 29-36 on pages 7-8 of Amdt. F, but left out col. 5, lines 36-41, which states that the hollow fiber wound bodies can be used in "heat and/or mass transfer".

Baurmeister is relevant to the teachings of Swozil et al. because both Swozil et al. and Baurmeister teach heat exchange elements. Applicant's statement that the "structure of Baurmeister i[s] incapable of removing large amounts of energy" is unsupported, and Applicant has not explained the relevance of this statement. Applicant's argument that the "structure of Baurmeister is itself permeable" is inconsequential: the fiber layer of Swozil et al., taken alone, would be permeable as well. There need not be a suggestion in Baurmeister that the fibers of Baurmeister should be embedded in a matrix. Swozil et al. teaches that the fibers are embedded in a matrix, Baurmeister teaches well known fiber arrangements for heat exchange. Applicant has not explained the relevance of the statement that "Baurmeister is clearly not intended to be a structural member of the hollow pipe variety".

10. Applicant's arguments regarding the applicability of O'Connor presented in the last paragraph of page 8 of Amdt. F have been fully considered but are not persuasive. These arguments do not appear to traverse the 35 U.S.C. 103 rejection of claims 64-67, but rather appear to argue that any combination of Swozil et al., Baurmeister and O'Connor does not result in the subject matter of claims 53 and 58, but Swozil et al. and Baurmeister teach the heat transfer element as claimed in claims 53 and 58 for the reasons provided above.

Conclusion

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Walter B. Aughenbaugh whose telephone number is 571-272-1488. While the examiner sets his work schedule under the Increased Flexitime Policy, he can normally be reached on Monday-Friday from 8:45am to 5:15pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Harold Pyon, can be reached on 571-272-1498. The fax phone number for the organization where this application or proceeding is assigned is to 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished

applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Walter B. Aughenbaugh
12/19/05 WBA

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1772 12/21/05